IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper C

Difficulty Rating: 3.32/1.0428

Time: 2 hours

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

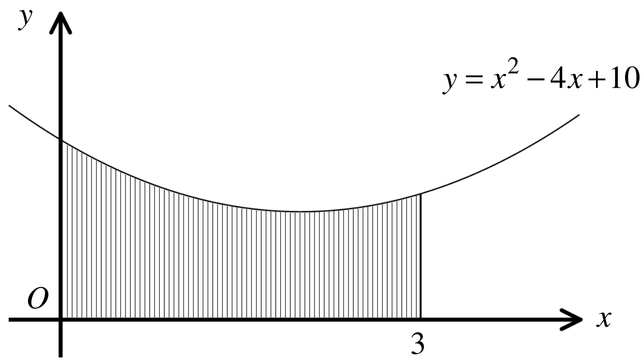
This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 12 questions in this question paper.
The total mark for this paper is 100.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1



The figure above shows the curve with equation

$$y = x^2 - 4x + 10, \ x \in \mathbb{R}.$$

Find the area of the region, bounded by the curve the coordinate axes and the straight line with equation $x = 3$. **(4)**

Question 2

$$f(x) = 2x^2 - 9x + 4, \ x \in \mathbb{R}.$$

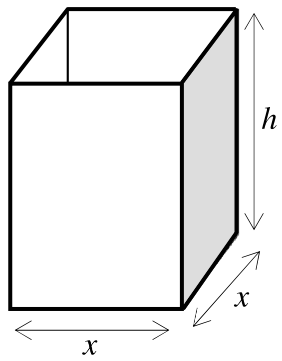
a) Sketch the graph of $f(x)$.

The sketch must include the coordinates of any points where the graph of $f(x)$ meets the coordinate axes. **(5)**

b) Solve the inequality

$$f(x) > 0.$$ **(2)**

Question 3



The figure above shows the design of a large water tank in the shape of a cuboid with a square base and **no top**.

The square base is of length x metres and its height is h metres.

It is given that the volume of the tank is 500 m^3.

a) Show that the surface area of the tank, $A \text{ m}^2$, is given by

$$A = x^2 + \frac{2000}{x}.$$ **(3)**

b) Find the value of x for which A is stationary. **(6)**

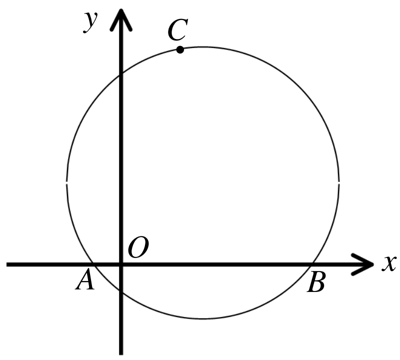
c) Find the minimum value for A, fully justifying the fact that it is the minimum. **(3)**

Question 4

Solve, in **degrees**, the following trigonometric equation

$$\tan(3x-75)° = \tan 450°, \quad 300° \le x < 500°.$$ **(5)**

Question 5



The figure above shows a circle that crosses the x axis at the points $A(-1,0)$ and $B(7,0)$, while it passes through the point $C(3,8)$.

Determine the coordinates of the centre of the circle and the length of its radius. **(8)**

Question 6

A curve has equation

$$y = 2^{3x}, \ x \in \mathbb{R}.$$

a) Describe the single geometric transformation which map the graph of $y = 2^{3x}$ onto the graph of $y = 2^{3x+4}$. **(2)**

b) Describe a **different** geometric transformation which map the graph of $y = 2^{3x}$ onto the graph of $y = 2^{3x+4}$. **(2)**

Question 7

Prove by exhaustion that if n is a positive integer that is **not** divisible by 3, then $n^2 - 1$ is divisible by 3. **(5)**

Question 8

A financial advisor wants to model the annual growth of a certain investment, based on the growth of this investment in the past seven years.

***n*, number of years**	1	2	3	4	5	6	7
***V*, in £1000**	44	48	55	63	67	75	82

He assumes the formula

$$V = 40\left(1+\frac{r}{100}\right)^n,$$

where r represent the **constant** annual percentage growth and n represents the number of full years that elapsed since the start of the investment.

a) State the initial value of this investment. **(1)**

b) Show that the data is consistent with his assumption, by using a graphical method, involving logarithms. **(6)**

c) Determine an estimate for the annual percentage growth of this investment, correct to two significant figures. **(4)**

d) Estimate the value of this investment after 10 years, briefly commenting on the reliability of this estimate. **(2)**

Question 9

$$f(x) = \frac{1}{x^3}, \quad x \in \mathbb{R}, \quad x \neq 0.$$

Use the formal definition of the derivative as a limit, to show that

$$f'(x) = -\frac{3}{x^4}.$$ **(7)**

Question 10

The straight line l_1 passes through the points $A(-4,-7)$ and $B(4,9)$.

The straight line l_2 has equation

$$y = \frac{1}{2}x + 4,$$

and meets the l_1 at the point C.

a) Determine an equation for l_1. **(3)**

b) Find the coordinates of C. **(4)**

The straight line l_3 is the bisector of the angle formed by l_1 and l_2.

c) Given that l_3 has positive gradient, determine an equation for l_3. **(5)**

Question 11

$$f(x) = (1+2x)^7$$

a) Determine the first four terms, in ascending powers of x, in the binomial expansion of $f(x)$. **(4)**

b) Hence, or otherwise, find the first four terms in the expansion of

$$\left(3+4x-4x^2\right)(1+2x)^6,$$

giving the answer in ascending powers of x. **(5)**

Question 12

A population P of an endangered species of animals was introduced to a park.

The population obeys the equation

$$P = \frac{125ka^t}{k + 2a^t}, \quad t \geq 0,$$

where k and a are positive constants, and t is the time in years since the species was introduced to the park .

Initially 100 individual animals were introduced to the park, and this population doubled after 5 years.

a) Show that $k = 8$. **(2)**

b) Find the value of a, correct to 4 significant figures. **(3)**

c) Determine the value of t when the $P = 400$. **(6)**

d) Explain why this population cannot exceed 500. **(3)**